REMARKS

Claims 1-3, 5-23 and 25-28 are pending in the present Application. In the present Response, claims 1, 10, 18, and 23 are amended. In view of the arguments below, withdrawal of the rejections and reconsideration of the application is respectfully requested.

First Rejection Under 35 U.S.C. § 102

The Examiner rejected claim 1 under 35 U.S.C. §102(b) as being anticipated by Macovski et al. (U.S. Pat. No. 5,835,995). Claim 1 has been amended. Applicants respectfully traverse this rejection.

Anticipation under section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985). For a prior art reference to anticipate under section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper rejection under section 102, a single reference must teach each and every element or step of the rejected claim. *Atlas Powder v. E.I. du Pont*, 750 F.2d 1569 (Fed. Cir. 1984).

As described in the present application, in MR imaging systems, it is desirable to maintain linear conduction of gradient current between the gradient amplifiers and the gradient coils. Failure to drive the gradient coils in the manner that closely conforms to the applied pulse sequence may result in poor imaging performance. Accordingly, in an MRI system, a switching assembly should be capable of linearly conducting gradient currents between positive and negative values and at near-zero values. Accordingly, the present switching assembly 90 includes each of a switching device 102 and a steering circuit 104. As illustrated in Fig. 5, the switching device 102 is coupled between the drive 101 and the load 103. The steering circuit 104 is coupled in parallel with the

switching device 102. As clearly stated in the description of Fig. 5, the steering circuit 104 is provided to direct the current between the drive 101 and the load 103 in the event that the switching device 102 cannot conduct current in a linear or uninterrupted manner. Thus, in applications in which linear conduction of current is a concern, the steering circuit 104 ensures that a current carrying path is provided between the drive 101 and the load 103 for the entire duration of any current flow, regardless of the magnitude of the current.

To be clear, the current steering circuit 104 is coupled in parallel with the switching device to provide an alternate path between the drive 101 (e.g., amplifier 96) and the load 103 (e.g., gradient coil 42) when the magnitude of the current is below a non-zero threshold value. As best illustrated with respect to Figs. 8 and 9 of the present disclosure, as the magnitude of the current approaches zero, the switching device 102 may fail to conduct current from the drive 101 to the load 103. The transition is clearly shown in waveform 152, which represents the portions of gradient current 135 which flow through the switching device 102, as it approaches the point 150, which indicates levels at which current 135 passes through the holding current threshold. Fig. 8, page 20, lines 12-25. The next waveform 160, which represents the current flow through steering circuit 104, as it approaches the point 151, which indicates levels at which current 135 passes through the holding current threshold. After passing the point 151, a second portion 158 of the waveform 152 represents the portions of gradient current 135 that again flow through the switching device 102. The steering circuit 104 is thus provided to conduct current at very low levels when the switching device 102 is in a non-conducting state.

Conversely, the Macovski et al. reference does not disclose a "first phase of operation dependent on the magnitude of the current." The Macovski et al. reference is directed to resolving issues with imaging time that is difficult because of cardiac and respiratory motion. Col. 1, lines 29-37. In the Macovski et al. reference, an energy recovery system is used to conserve the energy in generating the high fields desired to

correct the motion problems. Col. 3, lines 53-67. To adjust the ramp up and ramp down time, a system of switches and capacitors replaces the energy recovery system. Col. 4, lines 32-43. To control the flow of current, switches 21, 26, 32, and 34 are opened and closed to manage the ramp up and down ramp periods. Col. 4, lines 1-49.

In the rejection, the Examiner identifies the discussion of Figs. 3-5 of the Macovski et al. reference to disclose the recited feature. The Examiner again cited switches 32 and 34 as correlating to the steering circuit of the recited claims. However, the Macovski et al. reference fails to disclose *a switching device* having a "first phase of operation dependent on the magnitude of the current applied to the load." The Macovski et al. reference discloses moving the switch 21 to position 23 to charge the coil 11. Col. 4, lines 1-5. Subsequently, the switch 21 is opened and switch 26 is closed once a desired field is reached. Col. 4, lines 5-10. Finally, switch 26 is opened and switch 21 is moved to position 24. Col. 4, lines 10-13. The addition of switches 32 and 34 is utilized to decrease or increase the down ramp or up ramp time for the system. Col. 4, lines 31-49. Clearly, no phase of operation is *dependent* on the *magnitude of the current*, but is controlled by the switches 21, 26, 32, and 34. As such, the Macovski et al. reference fails to disclose a first phase that depends upon the magnitude of the current applied to the load.

In view of the remarks set forth above, Applicants respectfully submit that the subject matter of independent claim 1, as well as the claims dependent thereon, is not anticipated by Macovski et al. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejections and allowance of claim 1.

Second Rejection Under 35 U.S.C. § 102

The Examiner rejected claims 1-3, 5, 6, 10-13, 18, 23, 25 and 28 under 35 U.S.C. §102(e) as being anticipated by Van Groningen (U.S. Pat. No. 6,140,873). As the

Examiner rejected each of independent claims 1, 10, 18 and 23, which recite similar subject matter and were rejected based on the same elements of the Van Groningen reference, the independent claims 1, 10, 18 and 23 are discussed together.

As recited in the pending claims and as particularly described in the specification of the instant application, the switching device and the steering circuit are different, independent circuits that are connected in parallel to permit current to be supplied to a gradient coil assembly even when the switching device ceases to conduct current. It is clear that the steering circuit and the switching device comprise independent circuits that are configured to alternately conduct current depending on the current level of the input signal. As discussed above, the current steering circuit 104 is coupled in parallel with the switching device 102 to provide an alternate path between the drive 101 (e.g., amplifier 96) and the load 103 (e.g., gradient coil 42), which depends on the magnitude of the current. As shown in the waveforms 152 and 160, the steering circuit and the switching device operate to ensure that current is conducted to the gradient coil assembly during substantially the entire duration of the first current pulse.

Conversely, the Van Groningen reference is directed to resolving switching losses in amplifiers because of the switching over from one state to another. Col. 2, lines 30-43. To resolve this problem, the Van Groningen reference utilizes "soft switching," which is intended to minimize the current loss through the switches. Col. 2, lines 44-53. The reference teaches using a capacitor in parallel with a controllable switch to make sure that the voltage across the switches is nearly zero. Col. 3, line 61 to col. 4, line 21. The transistors 36 and 38 are controllable switches that are activated and deactivated by a control input. Col. 3, lines 30-42; col. 8 lines 7-26. The Van Groningen reference discloses three situations to illustrate the "soft switching" in the circuit, which involve switching over between a diode 42 and a transistor 36. Col. 7, line 46 to col. 9, line 33. In each of the situations, the voltage level at the switch is adjusted before being activated or deactivated. Col. 7, line 46 to col. 9, line 33. During the situations, a boost current

and a clamping phase may be used, while *the current through the load 70 is assumed to be constant*. Col. 7, line 46 to col. 8, line 36.

In the rejection, the Examiner asserted that the Van Groningen reference discloses all of the recited features. Further, the Examiner asserted that the transistors 36 and 38 are equivalent to the switching device and the components 60-1, 60-2, 60-3, 64-1, 64-2, and 64-3 are equivalent to the current steering circuit. However, the Van Groningen reference does not disclose or suggest all of the recited features of the claims. For example, the Van Groningen reference does not provide *a first phase of operation* or *a first portion* that is *dependent* on the *magnitude of the current applied to the load or gradient coil assembly* or a *second switching device or current steering circuit* having a *second portion of current to the load* or *gradient coils* being "below a non-zero threshold value."

The Van Groningen reference fails to disclose *a first phase of operation* or *a first portion* that is *dependent* on the *magnitude of the current applied to the load or gradient coil assembly*. In the rejection, the Examiner asserted that the transistors 36 and 38 are equivalent to the switching device recited in the claims. In the Van Groningen reference, the only discussion of the current through the load 70 is that it is assumed to be constant. Col. 7, lines 57-59; col. 9, lines 66-67. The magnitude of the current is not even a factor for the operation of the switches 36 and 38. This is because the switches 36 and 38 operate from a control input, not the magnitude of the current applied to the load. Col. 3, lines 30-42. Specifically, to comply with the soft switching, as taught by the reference, the *boost current*, and not the load current, is utilized to adjust the voltage differential across the switch 36 or 38 to nearly zero to allow the switch to switch over in a lossless manner. Col. 2, lines 44-51; col. 8, lines 7-23. Because operation of the switches 36 and 38 do not *depend* on the *magnitude of the current applied to the load or gradient coil assembly*, as recited in the claims, the switches 36 and 38 fail to anticipate the recited feature.

Further, the Van Groningen reference also fails to disclose a *second switching device or current steering circuit* having a *second portion of current to the load* or *gradient coils* being "below a non-zero threshold value." In the rejection, the Examiner asserted that components 60-1, 60-2, 60-3, 64-1, 64-2, and 64-3 are equivalent to the current steering circuit. However, as discussed previously, the only disclosure in the Van Groningen reference related to the current through the load 70 is that it is assumed to be constant. Col. 7, lines 57-59; col. 9, lines 66-67. In fact, the reference is devoid of any disclosure that the current through the load falls "below a non-zero threshold value" or that any action is taken based upon such events. Accordingly, the reference cannot disclose or anticipate a *second portion of current* to the *load* or *gradient coil assembly* that is "below a non-zero threshold value."

In view of the remarks set forth above, Applicants respectfully submit that the subject matter of independent claims 1, 10, 18 and 23, as well as the claims dependent thereon, is not anticipated by Van Groningen reference. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejections and allowance of claims 1-3, 5, 6, 10-13, 18, 23, 25 and 28.

First Rejection Under 35 U.S.C. § 103

Claims 7-9, 14, 15 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Van Groningen (U.S. Pat. No. 6,140,873) in view of Mansfield et al. (U.S. Pat. No. 4,820,986) or alternatively Macovski et al. (U.S. Pat. No. 5,835,995). As discussed above, all of the independent claims are believed to be allowable over the Van Groningen reference. The Examiner relied upon the Mansfield et al. reference or Macovski et al. reference to disclose or teach a "switching device comprises a silicon controlled rectifier (SCR)." However, the Mansfield et al. reference and Macovski et al. reference do nothing to obviate the deficiencies of the Van Groningen reference discussed above. Accordingly, all of the cited dependent claims are believed to be patentable for

the subject matter they separately recite as well as by virtue of their dependency on their respective allowable base claims 1, 10, and 18. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claims 7-9, 14, 15 and 19.

Second Rejection Under 35 U.S.C. § 103

The Examiner rejected claims 16, 20, and 26 under 35 U.S.C. 103(a) as being unpatentable over Van Groningen (U.S. Pat. No. 6,140,873) in view of Vavrek et al. (U.S. Pat. No. 5,311,135). As discussed above, all of the independent claims are believed to be allowable over the Van Groningen reference. In the rejection, the Examiner appears to rely on Vavrek et al. to the disclose or teach the "gradient coil assembly." However, the Vavrek et al. reference does nothing to obviate the deficiencies of the Van Groningen reference with regard to the deficiencies discussed above. Accordingly, all of the cited dependent claims are believed to be patentable for the subject matter they separately recite as well as by virtue of their dependency on an allowable base claim. Therefore, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claims 16, 20, and 26.

Third Rejection Under 35 U.S.C. § 103

The Examiner rejected claims 17, 22, and 27 under 35 U.S.C. 103(a) as being unpatentable over Van Groningen (U.S. Pat. No. 6,140,873) in view of Vavrek et al. (U.S. Pat. No. 5,311,135). As discussed above, all of the independent claims are believed to be allowable over the Van Groningen reference. In the rejection, the Examiner relied on Vavrek et al. to the disclose or teach the "a first gradient coil set and a second gradient coil set" and "the switch assembly selectively couples the amplifier to either the first gradient coil set or the second gradient coil set." However, the Vavrek et al. reference does nothing to obviate the deficiencies of the Van Groningen reference with regard to the deficiencies discussed above. Accordingly, all of the cited dependent claims are believed to be patentable for the subject matter they separately recite as well as by virtue

of their dependency on an allowable base claim. Therefore, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claims 17, 22, and 27.

Fourth Rejection Under 35 U.S.C. § 103

Claim 21 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Van Groningen (U.S. Pat. No. 6,140,873) in view of Vavrek et al. (U.S. Pat. No. 5,311,135) and Mansfield et al. (U.S. Pat. No. 4,820,986) or alternatively Vavrek et al. (U.S. Pat. No. 5,311,135) and Macovski et al. (U.S. Pat. No. 5,835,995). As discussed above, the independent claim 18 is believed to be allowable over the Van Groningen reference, and dependent claim 20 is believed to be allowable over Van Groningen in view of Vavrek et al. The Examiner relied upon the Mansfield et al. or Macovski et al. reference to disclose or teach "the first switch device and the third switching device each comprises a silicon controlled rectifier." However, the Mansfield et al. reference and Macovski et al. reference do nothing to obviate the deficiencies of the Van Groningen and Vavrek et al. references discussed above. Accordingly, dependent claim 21 is believed to be patentable for the subject matter it recites as well as by virtue of its dependency on allowable base claim 18. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claim 21.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the claims 1-3, 5-23 and 25-28. If the Examiner believes that a telephonic interview will help speed this Application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

General Authorization for Extensions of Time

In accordance with 37 C.F.R. § 1.136, Applicants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefor. Furthermore, Applicants authorize the Commissioner to charge the appropriate fee for any extension of time to Deposit Account No. 06-1315; Order No. 32-NM-5321/YOD (GEMS:0075).

Respectfully submitted,

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